corps of scientific men to accompany it; and this communication being favourably received, a number of gentlemen were duly commissioned. Some of these, however, subsequently found themselves unable to carry out their intention; but finally an organisation was completed, with Mr. J. A. Allen, of Cambridge, as zoologist; Dr. Lionel R. Nettre, of New York, as mineralogist and geologist; Mr. William Pywell, of Washington, as photographer; Mr. Edward Konopicky, of Cambridge, as zoological and landscape artist; and Mr. C. W. Bennett as general assistant. These gentlemen have been commended especially to the kind attentions of General Sheridan and Colonel Stanley, and will receive every facility possible for carrying on their work.

The next expedition is that of Prof. F. V. Hayden, who continues the work upon which he has been engaged for so many years. His starting-point is Denver, and the region to be explored lies south of the fortieth parallel of latitude, and extending from Green River on the west to the eastern base of the Rocky Mountains. He expects to occupy several successive years in proceeding toward the Mexican boundary. The expedition has been divided into several parties, each with its commander. The general topographical and surveying work is under the direction of Mr. James T. Gardner, so well known in connection with Mr. Clarence King's explorations. Some of the specialists accompanying the expedition are Dr. F. M. Endlich and Mr. Marvin as geologists, and Mr. J. H. Batty as zoologist.

The next survey in the geographical order of arrangement is that of Lieutenant George M. Wheeler, in continuation of the labours of several preceding years. This expedition will be divided into four main field parties, one of which will be again subdivided, and includes four astronomical and triangulation parties. Party No. 1, under charge of Lieutenant Wheeler himself, will operate in portions of New Mexico and Arizona, and will be accompanied by Mr. G. K. Gilbert as chief geologist, and Dr. Oscar Loew as assistant geologist. Party No. 2, under Lieutenant Hoxie, will be accompanied by Mr. E. E. Howell as geologist, and Mr. H. W. Henshaw as naturalist. This party will move from Salt Lake to Camp Wingate, passing through portions of New Mexico and Arizona. The third party, under Lieutenant William L. Marshall, with Prof. J. J. Stevenson as geologist and mineralogist, and Dr. J. L. Rothrock as medical officer and naturalist, will move south-west from Denver through to Wingate, and explore also a portion of New Mexico and Arizona.

The fourth, or triangulation party, will start from Santa Fé, and carry a system of triangulation west to the meridian of Fort Wingate, and thence south to the Mexican border. The first astronomical party will be stationed at Salt Lake, with Mr. J. H. Clarke as observer; the second will be on the Denver and Santa Fé line, Dr. F. Kampf, observer; the third will be on the Union Pacific and the Central Pacific Railroad lines, with William W. Maryatt as observer; and the fourth party at Ogden, with Prof. H. B. Herr as observer. Here an observatory will be constructed for receiving signals from communicating stations, with a view of establishing differences of longitude.

The expedition of Major J. W. Powell on the Colorado River, in Utah, comes next in order, this gentleman being now occupied in finishing his work and preparing his report in compliance with the Act of Congress. Major Powell had been several years in this region, and has already constructed a map of wonderful interest and great accuracy. In connection with his work he has made a very large ethnological collection relating to the Piute Indians.

The explorations of Mr. Clarence King, who has been engaged for several years in the survey of the line of the fortieth parallel, will, it is understood, be completed during the present season by reviewing some portions of the route already traversed.

The engineer expedition under Captain Jones will also proceed from Cheyenne along the Wind River Mountains to some point on the Upper Missouri, and will be accompanied by Dr. Parry, the well-known botanist. It is also understood that a large Government party will start from Fort Ellis and proceed eastward, and form part of the Yellowstone expedition already referred to.

The exploration of Alaska will also be prosecuted in behalf of the Coast Survey by Mr. William H. Dall, who has already proceeded to the Aleutian Islands, with a view of preparing a proper chart of the same, and especially of selecting a suitable landing-place for the proposed Pacific Ocean cable. The labours of Mr. Henry W. Elliott and Captain Bryant in the islands of St. Paul and St. George, in Behring Sea, will, it is hoped, be as productive as in 1872.

Nearly all the parties referred to, while, of course, prepared for prosecuting the topographical, geographical, and astronomical service, are accompanied by competent geologists, botanists, and zoologists, and there is reason to believe that the amount of material which will be transmitted by them to the National Museum will exceed in magnitude and value that of any previous year since its establishment in 1857.

NOTES

AT a meeting of the Geographical Society on Monday evening, Sir Bartle Frere, who was in the chair, intimated that the Queen had been graciously pleased to grant a pension of 300*l*. a year to Dr. Livingstone. We are glad to see that the daily press is becoming alive to the scandal of putting off with such a paltry gift a man who has spent his life in the disinterested service of his country and of humanity: he has surely *earned* something more handsome. Sir Bartle Frere read a letter from Dr. Kirk, which stated that the East Coast Expedition was getting on well, and that its members were in good health. Dr. Dillon and Lieutenant Cameron had succeeded in traversing the wet country, and were now engaged in collecting porters on the inland side of the river. Lieutenant Murphy and Mr. Moffat were understood to be following. His arrival had done much for the assistance of the expedition. No further news had of late been received of the expedition, a circumstance regarded by Dr. Kirk in a favourable sense. A letter from Lieutenant Grandy, from the Western Expedition, was then read. In this communication the writer, in giving an account of the progress of the expedition, stated that the men were all well, and that the climate was deliciously cool.

THERE will be an Election to Five Scholarships at Jesus College, Oxford, on Tuesday, October 14. The annual value of the Scholarships is 80*l*., and they are tenable to the close of the twentieth term from the Scholar's matriculation. Candidates must not on the day of election be full twenty-four years old. One of these Scholarships is an Open Scholarship. It will be given according to proficiency in Physical Science, combined with the Classical attainments required by the University. The Examination for this will commence on Tuesday, October 7, and it will be held at Magdalen College in company with that for a Magdalen Demyship and a Merton Post-Mastership. Papers will be set in Chemistry, Physics, and Biology; and an opportunity will be given of showing a knowledge of practical work in Chemistry and Biology. Candidates for this Scholarship, if not otherwise admitted to the Examination, are requested to call on the Principal of Jesus College, on Monday, Oct. 6; and if so admitted, to call upon him on any day in the same week, and to bring with them certificates of age and of past good conduct.

THERE will be an election to a Fellowship in Natural Science at Magdalen College, Oxford, in October next, the holder of which will not be required to take Holy Orders. The examination will be held in common with Merton College, preference being given to proficiency in Biology, the College reserving to themselves the power of taking candidates in any other branch of Natural Science if it shall seem expedient to do so. Candidates must have passed all the examinations required by the University of Oxford or University of Cambridge for the degree of Bachelor of Arts, and must not be in possession of any Ecclesiastical Benefice, or of any Property, Government Pension, or office tenable for life, or during good behaviour (not being an Academical office within the University of Oxford), the clear annual value of which shall exceed 230*l*. They must also produce testimonials of their fitness to become Fellows of the College as a place of religion, learning, and education, and these must be sent to the President on or before Monday, Sept. 29. Candidates are required to call on the President on Monday, Oct. 6, between the hours of 3 and 5, or 8 and 9 P.M. The examination will commence the following day.

DR. JAMES BOTTOMLEY, B.A., D.Sc., F.C.S., has been appointed to the Science Mastership of the Taunton College School. The liberality of two or three munificent friends has enabled the headmaster to place the science teaching on a new and enlarged footing. Science has been taught in the school since 1865 with imperfect instruments, accommodation, and teaching power, yet with sufficient thoroughness to pass many pupils in the London Matriculations and in the scientific portion of the Oxford Local Examinations. The apparatus will now be largely increased, a temporary but efficient laboratory is about to be erected, and a science master of the highest reputation has been secured.

THE fine specimen of the Octopus brought to the Brighton Aquarium from the French Coast in April last and suspected at the time by Mr. Saville Kent to be a female, has just verified this anticipation by depositing numerous eggs. The position selected by the creature for their lodgment is most opportune, the several clusters being attached to the rockwork, close to one another, within a few inches of the front glass of its tank; thus affording every facility for their observation to the general public, and enabling the officers on the Naturalist's Staff to watch their progress towards maturity from day to day. The eggs were deposited on Thursday last, the 19th inst., since which time the parent has vigilantly guarded them, usually encircling and partly concealing the whole within a coil of one or more of her snake-like arms, and vigorously repelling the near approach of any of her comrades in the same tank. Like those of the Argonaut or Paper Nautilus, the eggs of the Octopus are of small size compared with the ova of other Cephalopoda, the individuals being no more than one-eighth of an inch in length, of oval form, and are crowded round a central flexible stalk two or three inches long. A dozen or more of these compound clusters, each including over a hundred eggs, represent the number already deposited by the female Octopus in the Brighton tanks. The mate of the interesting parent is a fine fellow brought from the Cornish Coast last February. On the arrival of his fair companion he immediately vacated his oyster grotto in her favour and for many subsequent days lavished upon her the most assiduous attention.

MR. LIVINGSTONE STONE, the Assistant Commissioner on the part of the United States, has been engaged for some time past in collecting fresh-water fishes of various species to be transported to California, for the purpose of introducing them into the rivers and ponds of that State. For this purpose he had sent to him a car of the Central Pacific Railway, which he has had fitted up properly for this object. At one end of the car is a plank pond, lined with zinc and holding four tons of water, over which are berths for Mr. Stone and his assistants. The rest of the car is occupied with smaller tanks, and a reserve of sea and fresh water, household and commissary supplies, &c. Among the species that Mr. Stone carries with him, in the form of partly hatched eggs or young, are shad, cat-fish, yellow perch, wall-eyed or glass-eyed perch, eels, lobsters, and the like; and there is every reason to believe he will succeed in transferring his freight without material loss. If he accomplishes his object of placing these fish in the California waters, there is every reason to expect them to constitute before many years an important addition to the food resources of the State.

MR. BENTHAM'S Anniversary Address to the Linnean Society, just printed at the request of the Fellows, deals chiefly with the progress of physiological botany during the past year. He refers especially to Strasburger's investigations of the floral structure of Coniferæ and Gnetaceæ, and to the genealogical theory by which that botanist makes the Conifers the parent race from which the Gnetaceæ have directly descended, these again having engendered the higher Dicotyledons. This theory Mr. Bentham considers to rest on very slender grounds, preferring the hypothesis that the Gnetaceæ have remained the least modified from the common stock, the Coniferæ having undergone a greater progressive change in one direction, the total separation of the sexes, the Dicotyledons a greater advance in another direction, the increasing complexity of the floral development. Haeckel's conjectural pedigree of the Calcisponges is also criticised.

THE "session extraordinaire" of the Botanical Society of France will be held this year at Brussels under the auspices of the Royal Botanical Society of Belgium. The session will commence by a meeting at the Botanic Gardens, Brussels, on July 9, at 9 A.M. Excursions will be made to the botanical establishments at Brussels, Ghent, Liége, Antwerp, &c.; as well as to the grotto of Haux, the marshes of Hasselt, &c. English botanists are especially invited to take part in this meeting. The districts to be visited are stated to be of unusual interest from a botanical point of view.

THE subscriptions to the Sedgwick memorial give promise that a handsome museum will be erected to his memory. The amount already promised is very considerable. The Chancellor of the University, the Duke of Devonshire, heads the list with a donation of 1,000*l*. The High Steward, the Earl Powis, contributes 200*l*.; the Prince of Wales, 100 guineas; the Vice-Chancellor., Dr. Cookson, the two representatives in Parliament, the Right Hon. S. H. Walpole and Mr. Beresford Hope, as well as a large number of other gentlemen give 100*l*. each. The Earl of Derby has promised 200*l*., Prof. Selwyn, 500*l*.; the Master of Trinity College, 200*l*.; Prof. Lightfoot, 200*l*.

THE Royal Horticultural Society's Show at Bath was opened on Tuesday, and continues till Saturday.

THE official report of the Secretary of the U.S. Navy, respecting the Arctic exploring ship *Polaris*, dispels the suspicions respecting the manner of Captain Hall's death, and shows that the separation of the crew was accidental, but does not account for the failure of the *Polaris* to rescue the men on the ice. Important scientific results have been obtained. The supposed open Polar Sea proves to be a sound opening into Kennedy Channel, with an inlet on the east, probably marking the northern shore of Greenland. The *Tigress*, which has been purchased by the Navy department for the relief expedition, will start early in July.

THE Council appointed at the Conference of the Trades Guild of Learning, recently held at the Society of Arts, met on Saturday last. Amongst other business transacted it was resolved that in addition to various other eminent men, the following, as representatives of literature, science, and art, be invited to become vice-presidents of the guild:—Prof. Huxley, Sir Francis Grant, Mr. Alfred Tennyson, Dr. W. B. Carpenter, Prof. Tyndall, Sir Antonio Brady, Lord Lyttelton, Mr. Thomas Hughes, M.P., Mr. J. A. Froude, and Sir Sterndale Bennett. It was further resolved that the annual subscription for ordinary members be one shilling or upwards, and for associate members one guinea or upwards; that application should be made for donations to meet the preliminary expenses, and to furnish an income until the society is self-supporting; and that a prospectus of the objects and plans of the society should be issued as soon as possible.

COMMODORE SELFRIDGE has returned to the Navy Department at Washington, bringing with him the materials for presenting a detailed report of his exploration upon the Isthmus of Darien during the past winter in reference to the construction of an inter-oceanic ship-canal. The result of his inquiries has been much more favourable than was anticipated, and it is now estimated that only twenty-eight miles of canal need be constructed, the remainder of the distance consisting of the perfectly navigable waters of the Atrato, Doguado, and Napipi rivers. A tunnel will still be necessary, as estimated on a previous exploration, but this will only require to be three miles in length, instead of five, and it is estimated that the entire distance can be completed at a cost of less than 70,000,000 dols. Twenty-two miles of the canal are over an almost level plain, and only nine locks in all will be needed.

WE have just received the first number of the Bulletin, or Proceedings of the Society of Natural History of Buffalo, New York. Four similar numbers are to be issued each year, with a few plates. The number before us is solely occupied by the work of Mr. Aug. R. Grote, who contributes four papers describing new North American Moths, and giving catalogues of the Sphingidae and Zygaemidae of North America, followed by conclusions drawn from a study of the genera Hypena, and Herminia.

SINCE the diffraction spectrum differs from a prismatic spectrum of the same length in having the less refrangible rays more widely dispersed, it some time ago suggested itself to Prof. C. A. Young that a so-called *gitter-platte* or "grating" of fine lines might advantageously replace the prisms in spectroscopes designed for the observation of the solar prominences through the C line. Having recently obtained one of the beautiful gratings ruled upon speculum metal, having a ruled surface of something more than a square inch, the lines being spaced at intervals of $\frac{1}{6480}$ of an inch, he combined this with the collimator and telescope of a common chemical spectroscope, thus getting an instrument furnishing a spectrum of the first order, in which the D lines are about twice as widely separated as by the flint glass prism of 60° belonging with the original instrument. In the neighbourhood of C the dispersion is nearly the same as would be given by four prisms. The spectra of the higher orders are generally not so well seen on account of their overlapping each other, but fortunately with one particular adjustment of the angle between the collimator and telescope, the C line in the spectrum of the third order can be made to fall in the vacant space between the spectra of the second and fourth orders. On applying the new instrument to the equatorial, Prof. Young found that in the first order spectrum he could easily see the bright chromosphere lines C, D_3, and F; he could also, though with great difficulty, make out Hγ, (2796K). On opening the slit the outline of the chromosphere and the forms of the prominences were well seen, both in the spectra of the first and third order. The grating is much lighter and easier to manage than a train of prisms, and if similar ruled plates can be furnished by the opticians at reasonable prices and of satisfactory quality, it would seem that for observations upon the chromosphere and prominences they might well to some extent supersede prisms.

THE Eleventh Annual Report of the Free Libraries Committee of Birmingham is very carefully drawn up. It contains some valuable analytical tables showing the average numbers of those who daily take advantage of the library, the ages of the readers, their occupations, along with the number of volumes issued to readers of each occupation, and tables showing the books most in demand. From the latter item we are glad to see that science in its various departments comes in for a very fair share of attention. In April 1872 the Reference Library and the Art Gallery were thrown open to the public on Sunday afternoons, and to judge from the statistics, the privilege has been taken considerable advantage of, especially by those who have least time during the week for mental improvement.

IN the last number of the *Journal of the Statistical Society* is an interesting paper by Mr. F. Galton, F.R.S., on the Relative Supplies from Town and Country Families to the population of future generations. Mr. Galton took for the purpose of comparison, from the census returns, 1,000 families belonging to Coventry, in which there are various industries, and where the population is not increasing, and 1,000 families from small agricultural parishes in Warwickshire. After careful comparison and calculation, based on ascertained data, Mr. Galton concludes that the rate of supply in towns to the next adult generation is only 77 per cent., or, say, three-quarters of that in the country. In two generations the proportion falls to 59 per cent., that is, the adult grandchildren of artisan townsfolk are little more than half as numerous as those of labouring people who live in healthy country districts.

THE Reports and Proceedings for the year 1872-3 of the Miners' Association of Cornwall and Devon, contain some good papers, mostly of a practical nature, in connection with mining.

WE have received the Monthly Notices of the papers and proceedings of the Royal Society of Tasmania for 1870, 1871, and the half of 1872. A great part of them are occupied with valuable meteorological observations and statistics, and from the reports of the society's meetings and the numerous papers printed *in extenso* on subjects connected with all departments of science, we judge the society to be in a healthy condition. As might naturally be expected, many of the papers are devoted to the practical aspects of science, to pisciculture, arboriculture, agriculture, the rearing of sheep, &c.

WE would recommend to anyone visiting Derbyshire, especially the district around the Peak, Mr. Bates's little "Handbook to Castleton and its Neighbourhood," containing very full and well-compacted information on all the places of interest around. There is a useful section on the geology, mineralogy, and botany of the district, and we believe that Mr. John Tym, of Castleton, the publisher of the book, well known as a geologist, will willingly give anyone who calls at his shop, information on the natural history of the district.

WE would recommend to all Londoners who are at a loss how to spend an occasional holiday to procure the summer edition of Mr. Henry Walker's "Half-Holiday Guide," which is wonderfully cheap considering the quantity of matter it contains. It would take a few summers of half-holidays to exhaust all the charming resorts around London he describes. The book also contains much useful information for the botanist, geologist, ornithologist, entomologist, and microscopist, as well as with regard to various sports. Mr. Walker should, however, cease to quote so much irrelevant verse.

THE following additions have been made to the Brighton Aquarium during the past week:—Two Puffins (*Fratercula arctica*); small Crocodile (*Crocodilus sp.*) from Sumatra, presented by Captain Murray; Bass (*Labrax lupus*); Black Bream (*Cantharus lineatus*); Streaked Gurnards (*Trigla lineata*); Mackerel (*Scomber scomber*); Lumpfish (*Cyclopterus lumpus*); Grey Mullet (*Mugil capito*); Ballan Wrasse (*Labrus maculatus*); Flounders (*Pleuronectes flesus*), fresh-water variety, presented by F. J. Evans, Esq.; Herring (*Clupea harengus*); Conger Eels (*Conger vulgaris*); John Dorée (*Zeus faber*); Sea Horses (*Hippocampus ramulosus*) from the Mediterranean; Octopus (*Octopus vulgaris*); Oysters (*Ostrea edulis*); Zoophytes (*Actinoloba dianthus*), (*Sagartia nivea*), (*S. miniata*), (*Alcyonium digitatum*), (*Tubularia indivisa*).

THE additions to the Zoological Society's Gardens during the past week include a Dormouse Phalanger (*Dromicia nana*) from Tasmania, presented by Mast. W. F. Stratford; a Coati, brown variety (*Nasua nasica*) from S. America, presented by Mr. G. P. Crawford; a Lion (*Felis leo*) from Africa, presented by the Hon. M. E. G. Finch Hatton; a Rhesus Monkey (*Macacus erythreus*) from India, presented by Mr. J. C. Freeman; a Tasmanian Rat Kangaroo (*Hypsiprymnus cuniculus*), presented by Mr. J. Shelton; a Garnet's Galago (*Galago garnetti*) from E. Africa, presented by Mr. Bartle Frere; two horned Lizards (*Phryrosoma cornutum*) from Texas, presented by Mr. W. L. Booker; a Clifford's Snake (*Zamenis cliffordii*) from Cairo, presented by Mrs. E. Liveing; a black Stork (*Ciconia nigra*), two white Storks (*C. alba*), and a Spoon-bill (*Platalea leucorodia*), purchased; a red Kangaroo (*Macropus rufus*), and a Fallow Deer (*Dama vulgaris*), born in the Gardens.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 15.—"On the Heating of a Disc by Rapid Rotation *in vacuo*." By Prof. Balfour Stewart, M.A., F.R.S., and Prof. P. G. Tait, M.A.

In two previous communications to this Society, we gave an account of some experiments which we had made upon the heating of a disc through rotation *in vacuo*. In these experiments the increase of radiation of the heated disc was observed by means of a delicate thermopile and galvanometer. Three aluminium discs of various thicknesses and one ebonite disc were used, and the results derived from the experiments were as follows:—

(1) The heating effect observed appeared to be independent of the density, and of the chemical constitution of the residual air and vapour surrounding the discs.

(2) The quantity of heat developed under similar circumstances of rotation in three aluminium discs ·05, ·0375, ·025 of an inch in thickness respectively appeared to be the same, inasmuch as the relative thermometric effect for these discs varied inversely as their thickness.

(3) Besides the heating effect alluded to in (1) and (2), there was found to be, when the vacuum had been recently made, a strictly temporary effect, sometimes in the direction of heat, sometimes in that of cold, owing probably to the condensation or evaporation of small quantities of aqueous vapour; but this effect was only noticeable during rotation, disappearing the moment the motion was stopped.

In June 1871 the experiments were resumed. In the mean time the apparatus had been fitted with an arrangement working through a barometer-tube, by means of which, instead of trusting to radiation, the disc itself might, after rotation, be tapped by means of the pile, which could be brought up to it and then withdrawn. By this means a much larger effect might be obtained, and it became possible, by varying the adjustment, to find according to what law the heat-effect varies with the distance from the centre.

These experiments were conducted in the following manner: The disc was first of all tapped before rotation several times; at each tapping the momentary swing of the needle was recorded, and the mean of the readings was regarded as indicating the state of the disc with respect to heat.

The disc was next tapped after rotation, and the difference between the readings before and after was taken as indicating the change in the state of the disc produced by rotation.

The results derived by tapping an ebonite disc were found to be very different from the radiation-results, inasmuch as in the former the effect of the pressure and quality of the residual air is very apparent, while in the radiation-results it is hardly perceptible. A probable explanation of this will be given afterwards, but in the mean time, in view of these results, it has been thought expedient to discuss them quite independently and by themselves, with the view of ascertaining whether they can best be explained by a gas-effect alone, or whether they likewise indicate a residual effect independent of gas.

With this object calling A B the results at $\frac{9}{20}$ and $\frac{3}{20}$ let us take $\frac{(A)+(B)}{2}$ as representing the *whole effect* at a pressure of $\frac{6}{20}$ in. due to whatever cause or causes. We thus obtain

	Dry hydrogen.	Dry air.	Dry carbonic acid.
Whole effect at $\frac{6}{20}$ . .	9·5	25·0	24·0

Again, let us suppose that (A) – (B) denotes the *gas effect* for $\frac{6}{20}$ in., and we obtain

	Dry hydrogen.	Dry air.	Dry carbonic acid.
Gas-effect at $\frac{6}{20}$ . . .	4·0	20·0	18·0

Finally, let us regard as *unknown residual effect* the difference between the *whole effect* and the *gas-effect*, and we obtain

	Dry hydrogen.	Dry air.	Dry carbonic acid
Residual effect . . .	5·5	5·0	6·0

Similar experiments with the same galvanometer were made with a disc of cartridge-paper, of which the pores were filled with solid paraffin.

Treating these results in the same manner as those of the ebonite disc, we obtain:—

	Dry hydrogen.	Dry air.	Dry carbonic acid.
Whole effect ($\frac{6}{20}$) . .	25·0	45·0	43·5
Gas-effect ($\frac{6}{20}$) . . .	4·0	20·0	23·0
Residual effect . . .	21·0	25·0	20·5

Now, if we suppose that there is only one effect due to gas, it follows:—

(α) That the proportion between the effects due to the various gases experimented on (and all of the same pressure) is nevertheless different for the two discs.

(β) That the proportion (for the same disc) between the effects due to the various gases experimented on is different according to the pressure.

If, however, we suppose that there are two effects, one of which is independent of the residual gas, we find:—

(α) That, as regards the *gas-effect*, the proportion between that due to the various gases is nearly the same for both discs. Thus in the ebonite disc we have 4, 20, 18, while in the paper disc we have 4, 20, 23 as representing the gas-effect for the various gases.

(β) That the *residual effect* in either disc is nearly the same for the various gases. Thus in the ebonite disc we have 5·5, 5·0, 6·0, while in the paper disc we have 21·0, 25·0, 20·5 as representing the residual effect for the various gases.

The results are thus much more simple on the hypothesis of two effects, one of these being independent of the residual gas, than on the hypothesis of only one effect.

It was next endeavoured to ascertain whether these two effects were differently influenced by a blind, and it was found that the proportion between the two effects is greatly altered by the blind, so that while the hydrogen effect is not much stopped, the other is diminished very considerably; it was therefore concluded that the residual effect is not much altered by a chamois leather blind.

It was suggested to us by Prof. Helmholtz that it would be desirable to ascertain whether any difference was produced in the results by loading the disc on one side; for if these results be due to vibration, it might be supposed that they would be affected by this means.

It has been seen that the residual effect obtained from a disc covered with chamois leather is approximately the same as that from an uncovered disc; this would appear to us to be against the vibration hypothesis.

In an experiment made the disc was covered with a chamois leather blind with a segment cut out.